NSW GOVERNMENT

Draft NSW Invasive Species Plan 2015–2022

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Executive Summary

Invasive plants and animals are among the most serious threats to primary production industries and the natural environment in NSW. Pest animals displace native species through predation and competition, and destroy crops and native vegetation by grazing and trampling. Pest animals are also considered the primary cause of native mammal extinctions in Australia. Weeds can cause significant yield losses to cropping industries, they out-compete native plants and impact biodiversity. Pest animals and weeds cause significant financial losses to agriculture and other industries and damage areas of cultural significance.

Common pest animal species in NSW include wild dogs, rabbits, foxes, carp and feral cats, pigs and goats. In addition, small invertebrates such as tramp ants and certain exotic bees can also devastate the economy and environment.

There are over 1650 introduced plant species which have become established in the wild in NSW, and at least 300 of these are considered significant weeds impacting the environment and agricultural production.

The most effective way to manage invasive species is to prevent their incursion in the first place. Invasive species have the ability to establish rapidly in new areas and successful eradication requires a timely and rapid response. Unfortunately, many invasive species are already established in NSW and their eradication across large areas is not achievable with existing control methods. Priorities for the control of these species must be determined, focusing resources on areas where the benefits of control will be greatest.

The Invasive Species Plan 2015-2022 (the Plan) aims to outline mechanisms to prevent new incursions, contain existing populations and adaptively manage widespread invasive species. The overall goal is to foster and support a cooperative culture where everyone contributes to minimising the impacts of invasive species in NSW.

The Plan adopts four goals to achieve this:

- Exclude – prevent the establishment of new invasive species.
- Eradicate or contain – eliminate, or prevent the spread of new invasive species.
- Effectively manage – reduce the impacts of widespread invasive species.
- Capacity building – ensure NSW has the ability and commitment to manage invasive species.

The Plan builds on and further develops the principles of its predecessor (the NSW Invasive Species Plan 2008-2015). In particular, changes in this Plan include defining the invasion curve, explaining invasive species management options, as well as the need for and application of risk assessment, prioritisation and monitoring.

Invasive species affect us all: government, industry, land holders and the community. This Plan further clarifies roles and responsibilities for everyone in invasive species management in NSW.

Have your Say

A review of the NSW Invasive Species Plan was recently undertaken to ensure that objective programs with high standards continue to be applied to all aspects of the management of invasive species in NSW.

An updated Invasive Species Plan 2015-22 has now been drafted by DPI in collaboration with public land managers (Local Land Services, Crown Lands and NSW National Parks and Wildlife Service), and is open for public consultation.

DPI encourages landholder and community feedback to ensure we have correctly identified priorities and to help guide future investment in invasive species management. Following the consultation process all comments received will be reviewed and considered for incorporation into the final plan.

Public consultation on the draft plan closes on 2 October 2015. Those interested can submit written comments on the consultation document to DPI by email to invasive.species@dpi.nsw.gov.au.

Further detail can be found on the DPI website.

Introduction

Invasive species affect our environment, economy and social wellbeing. They can reduce the productivity of our land and waterways and reduce biodiversity in natural areas. Invasive species can out-compete or prey on native species and can spread disease. They can also damage buildings, roads, wharves and other structures. These impacts are further detailed on p6 and ways to prioritise addressing the impacts of invasive species is outlined on p11-12.

The NSW Invasive Species Plan 2015-2022 (the Plan) replaces the NSW Invasive Species Plan 2008-2015, and continues its goal of outlining and coordinating responses to minimise the impacts of invasive species in NSW, using a risk-based approach. This Plan identifies priorities and will guide future investment in invasive species management.

The Plan aims to prevent new incursions, eliminate or contain existing populations and effectively manage already widespread invasive species. Its scope includes weeds, vertebrate and invertebrate pests in terrestrial, freshwater and marine environments. While acknowledging that some native species have pest characteristics (for example where they occur outside their native range and behave invasively), native species are not specifically covered by, nor are they a target of this Plan.

The Plan provides a state level framework for the coordinated and cooperative management of invasive species. It complements other existing strategies, in particular the NSW Biosecurity Strategy, the Australian Pest Animal Strategy, the Australian Weeds Strategy and the National System for the Prevention and Management of Marine Pest Incursions. It also provides links to regional and other plans, as well as various species-specific plans, both in preparation and those already in existence.

All stakeholders – government agencies, industry, landholders and members of the community play a valuable role in confronting the challenges and achieving the goals and actions outlined in this Plan.

Principles of the NSW Invasive Species Plan

This Plan continues to promote the invasive species management principles which were developed in the NSW Invasive Species Plan 2008-2015:

Planning

- Invasive species issues are properly defined before developing or implementing any control strategy.
- Management decisions are based on the best available knowledge.
- Management of invasive species is most cost effective when new incursions are detected early and rapid responses are implemented.
- Strategic management programs are developed with an informed and skilled community.
- Sound policy and legislative frameworks are developed.

Effective management

- Targeted, coordinated and integrated programs which complement national and state strategies are most efficient and effective.
- An adaptive management approach incorporates monitoring of outcomes, changing technology, knowledge and circumstances.
- Control strategies reflect and adapt to changing environmental conditions.
- Activities are monitored to measure effectiveness.
- Priority is given to invasive species management where it will deliver the greatest benefits.

Decision-making

- Management decisions are underpinned and informed by risk management systems.
- Cost-effectiveness, humaneness and target-specificity considerations are balanced.
- The variety of social and ethical values is recognised.
- The inherent value of native species and natural ecosystems is recognised.
- Best practice approaches are adopted which minimise adverse effects of management on off-target species and the environment.
- Integrated pest and weed management techniques are used where appropriate.

Impacts of invasive species

Invasive species cause financial losses to agriculture and other industries and damage areas of ecological value and cultural significance. Managing the impacts of pests is an issue of great importance for managers of all land tenures. The issue requires sustained, long-term effort to minimise damage by pests to economic, environmental and social values.

There have been significant declines in and extinctions of Australia's native flora and fauna since the arrival of European settlers, with introduced pest animals and plants contributing to much of this loss. With new pests being detected all the time, invasive species represent one of the greatest threats to biodiversity in Australia.

Wild dogs, feral pigs, rabbits, foxes, feral goats, feral cats and carp are the key pest animals occurring in NSW. Other pest animals, such as feral horses, wild deer, rats and cane toads cause localised problems. Pest birds such as common mynas, introduced turtles (for example red eared sliders) and invertebrate pests (such as invasive ants) are emerging potential threats. It is estimated that pest animals cost the Australian economy over $1 billion annually.

Over 1650 introduced plant species have become established in the wild in NSW, with at least 300 of these weeds having significant environmental impacts. In many cases weeds form monocultures which displace native species. Throughout agricultural areas, weeds can out-compete crops and pasture species, resulting in lower economic returns and the need for expensive and ongoing control measures.

Many weeds are the result of historic deliberate introductions for ornamental or agricultural purposes. Some of the most invasive species are bitou bush, lantana, blackberry, privet, perennial grasses and vines such as Madeira vine. New weed species are being found in Australia every year.

More than 250 introduced marine species have been detected in Australian coastal waters to date. Marine pests such as the northern Pacific seastar and Japanese kelp in Tasmania and Victoria, and the Asian green mussel in Cairns, can create serious problems for marine environments and animals, as well as the industries and communities they support. Freshwater pest fish, such as carp and tilapia, can also out-compete native species. Aquatic pests, both marine and freshwater, pose a significant risk to the profitability of Australia's $2.4 billion-a-year fisheries and aquaculture industries.

Invasive species can cause substantial damage to buildings, roads, infrastructure and equipment. For example, weeds can damage road surfaces resulting in high maintenance costs, and pest bird species such as starlings have been known to damage telecommunication equipment. Aquatic pest species that foul the hulls of watercraft, damage wharves and block waterways can seriously disrupt boating, shipping, port and wharf operations.

Roles and responsibilities in invasive species management

A wide range of organisations and people are involved in invasive species management in NSW. This Plan recognises the variety of roles that exist, and attempts to consolidate these efforts through better coordination and communication between organisations and individuals.

Department of Primary Industries

The Department of Primary Industries (DPI) is the lead agency for invasive species management within the NSW Government. DPI represents the NSW government at several national forums where invasive species management is discussed and coordinated. Through this engagement NSW is a signatory to a number of national agreements relevant to biosecurity, including the Intergovernmental Agreement on Biosecurity (IGAB), the Emergency Animal Disease Response Agreement (EADRA), the Emergency Plant Pest Response Deed (EPPRD) and the National Environmental Biosecurity Response Agreement (NEBRA).

These agreements outline the roles and responsibilities of government and industry in responding to emergency animal diseases, weeds and plant pest incidents and detail how those responses are funded.

In NSW, DPI's key roles include:

- Administration of key legislation relating to priority weeds and pest species.
- Partnering with others to achieve the planned outcomes of the NSW Invasive Species Plan, forming partnerships and identifying and delivering funding opportunities to support key initiatives.
- Building awareness about invasive species in industry, key stakeholders and the community.
- Leading and coordinating prevention, preparedness, response and recovery programs to best manage incursions of significant emergency pests and weeds.
- Administering licencing systems for recreational hunting on public land and for the keeping of certain permitted non-indigenous animals.
- Developing and maintaining regulatory mechanisms that support invasive species programs.
- Developing non-regulatory approaches and incentives to underpin invasive species management.
- Protecting and managing systems through effective pest and weed management.
- Coordinating diagnostic, surveillance, tracing and monitoring systems for priority species.
- Conducting invasive species research in priority areas.
- Coordinating the delivery of best practice solutions for weed managers across the state.
- Collaborating with universities, museums and research providers on priority research initiatives and pest and weed identification.

DPI also leads the coordination of invasive species management activities in NSW generally. However, in practice invasive species management is best achieved through the collaboration of a number of government agencies, public and private land managers, industry and the community. The roles and responsibilities of some key partners are briefly outlined:

Crown Lands

Crown Lands is a business unit of DPI and administers Crown Land, which makes up approximately half the state. Crown Lands develops and implements invasive species management strategies on land under its direct control. It also supports activities undertaken by community groups and other stakeholders that manage land on its behalf.

Local Land Services

Local Land Services (LLS) plays a key role in delivering invasive species outcomes in NSW. LLS was established in 2014, combining the previous Livestock Health and Pest Authority and Catchment Management Authorities. LLS develops key strategies in its Local Strategic Plan and Biosecurity Operational Plan to combat the impact of invasive species on production, plant and animal systems and the environment.

LLS has advisory and compliance functions as prescribed under the *Local Land Services Act* 2013, and is responsible for large scale co-ordination and advice for best practice, on ground control methods, training and compliance for invasive species. LLS is also the sole distributor for the vertebrate pest poison 1080 (sodium fluoroacetate) in NSW and provides 1080 training for landholder groups.

LLS provides information on the impact of invasive species on natural resources and assists community groups, Landcare and other stakeholders to seek financial assistance and funding for large scale co-ordinated programs.

Office of Environment and Heritage

The Office of Environment and Heritage (OEH) develops and implements management strategies for invasive species on more than 7 million ha of lands managed under the *National Parks and Wildlife Act* 1974. OEH works collaboratively with stakeholders including Local Land Services and Regional Weed Advisory Committees. OEH also develops, coordinates and reports on statewide initiatives to reduce the impacts of invasive species on biodiversity. Initiatives include the Saving our Species program and individual threat abatement plans for invasive species. As such, OEH also has an advisory role to DPI on environmental invasive species management across NSW.

Local Control Authorities

Local Control Authorities (Local Councils and County Councils; LCAs) are responsible for the implementation of priority weed control (under the *Noxious Weeds Act* 1993), including: enforcing the Act, conducting inspections, controlling weeds on LCA managed lands, developing weed strategy and policy, and providing education, training and resources for both the public and for staff. LCAs together with Regional Weed Advisory Committees have the primary responsibility for delivering the NSW Weed Action Program throughout the state. Local control authorities also have obligations under the *Local Land Services Act* 2013 and *Companion Animals Act* 1998 to manage both pest and domestic animals on land they own, occupy or manage.

Other Government land managers

All Government departments that manage land have an important role in the management of invasive species in NSW. These areas include land reserved for its biodiversity, historic or scenic value, land that has a commercial value containing harvestable resources, land used for the State's infrastructure or transport corridors and land that has not been claimed for any specific purpose. The role of public land managers includes the development and implementation of pest management strategies and the education of the community and other stakeholders.

Industry

Industry has three main roles in invasive species management: (a) managing pests on land and in aquatic environments used for production; (b) managing risks when trading in potential or known invasive species used for, or held by, nurseries, zoos and collectors, agriculture, horticulture, aquaculture and biofuel developments; and (c) managing vectors or pathways for invasive species to prevent the establishment of invasive species, through movement of goods, produce and equipment or related activities such as the disposal of ships' ballast.

Special interest groups and community organisations

This Plan recognises the important role community volunteers and special interest groups play in the management of invasive species in NSW. These groups and individuals provide thousands of hours each week assisting in the management of private and public lands through direct invasive species control and monitoring activities, while others work on conserving biodiversity which increases the resilience of our natural environment to pests and weeds. Building capacity throughout the community and sharing biosecurity responsibilities is essential.

General public

All members of the community have an important role to play to help minimise the impacts of invasive species. We can all be effective "eyes and ears" to detect and report new incursions, and eradication attempts need community support to be successful. Land owners, occupiers and the public in general also have roles to play in the ongoing management of established pest animals and weeds on their own land and in collaboration with their neighbours and community.

The following table provides a generic illustration of these roles and responsibilities.

Table: Representation of roles and responsibilities

Role or Activity	Responsibility			
	Occupier (rural /urban)	Community or local council	State government	Federal government
1. On-farm biosecurity	PR	NR	NR	NR
2. On-farm pest control	PR	NR	NR	NR
3 Backyard management	PR	SR	NR	NR
4. Public land management	PR	SR	SR	NR
5. Commercial production (eg agriculture, horticulture etc)	PR	NR	NR	
6. Legislation	NR	NR	PR	SR
7. Stakeholder awareness	SR	SR	SR	NR
8. Hands on/field activities (eg treatment, spraying, trapping)	PR	SR	SR	NR
9. Diagnostics/identification	PR	SR	PR	NR
10. Domestic market access	SR		PR	NR
11. Export market access	SR	NR	SR	PR
12. Training and engagement	PR	SR	SR	NR

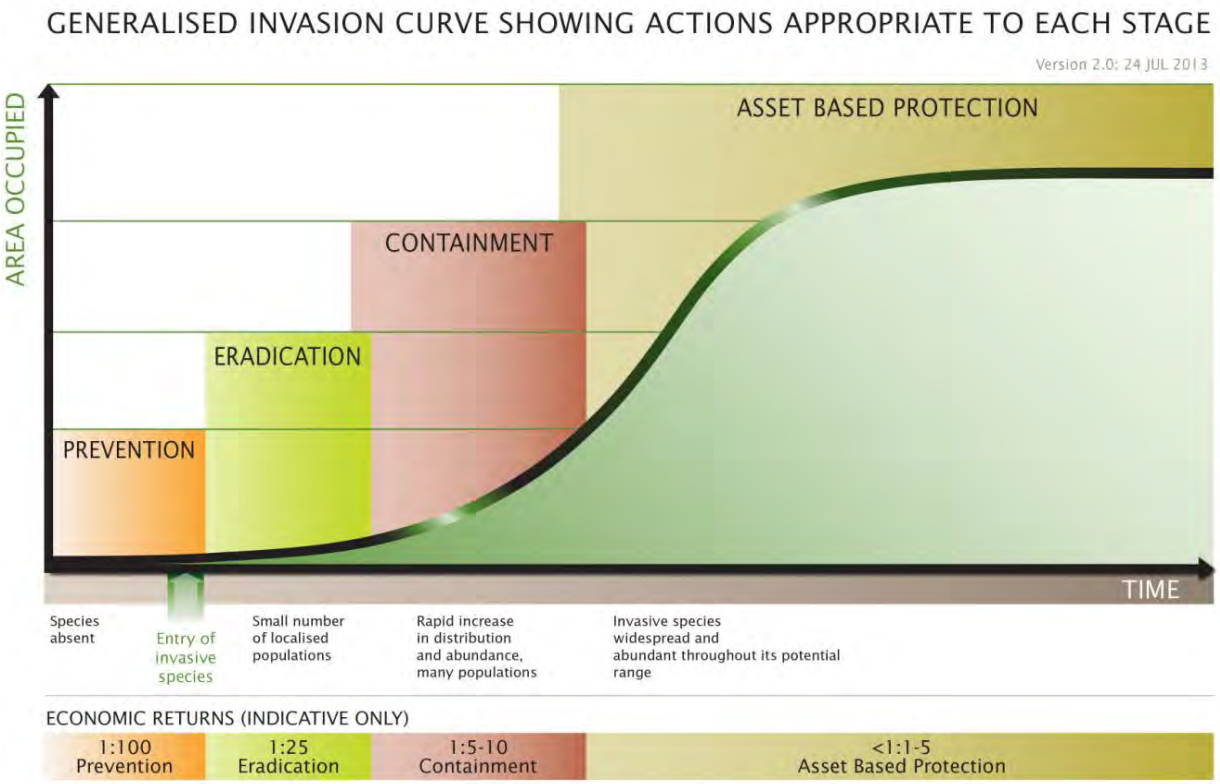
Key to colours

PR	Means this group has primary responsibility
SR	Means a shared responsibility
NR	Means no responsibility

The invasion curve and return on investment

The generalised invasion curve illustrates changes over time if pests and diseases successfully invade new areas and the different actions appropriate to counter invasion at each stage. The return on investment for different stages in invasive species management is also shown, along the bottom axis.

Figure: Invasion Curve, sourced from Biosecurity Victoria, Department of Primary Industries, Victoria



The invasion curve highlights that the most cost-effective approach to invasive species management is achieved through preventing the entry of new threats. Unfortunately however, prevention is not always possible. The next highest return on investment in the management of invasive species is achieved by early intervention and eradication, which is really only possible when a small number of localised populations of the pest have invaded. If early intervention is unsuccessful and/or the pest spreads, eradication is no longer a feasible goal.

Full landscape management of widely established pests is the least cost-effective approach, and is the major reason why widespread pests should be risk-assessed to focus effort and investment on the identification and protection of significant environmental, economic and social assets.

Prioritisation and invasive species management

Invasive plants and animals are among the most serious threats to the NSW natural environment and primary production industries. However, as with all things, the resources (both human and financial) available to address the risks and impacts of invasive species are limited, and activities and investment must be prioritised.

Invasive species management can be classified under four approaches: Prevention, Eradication, Containment and Asset-Based Protection. These four approaches are aligned with the invasion process from arrival to widespread establishment (as illustrated in the Invasion Curve on the previous page).

The most effective way to minimise the impacts of invasive species is to prevent their initial incursion in the first instance. This requires being able to identify high risk species, thoroughly assess their potential invasiveness and implement effective barriers to prevent their establishment. The risks posed by an incursion of a novel invasive species (animal or plant) is informed by data on whether it has invaded other countries, information on its native range, preferred habitat, suitable climate and how well this matches conditions in NSW and Australia. Formal risk assessment techniques for invasive species estimate likelihood (including of successful reproduction, establishment and spread) and consequences (including environmental and economic impacts and social considerations).

New incursions can colonise areas rapidly and successful control will be highly dependent on a timely and rapid response. The challenge in the initial stages of establishment is to ensure early detection, reporting and rapid action by developing and deploying effective and efficient ways to eradicate or contain the introduced species before it becomes widespread. This usually results in a species-led approach.

Once widespread, the eradication of pest animals and plants over wide areas of different land tenure is rarely practical. Priorities for the control of these species must be determined and resources focussed in areas where the benefits of control will be greatest. A strategic or site-led approach is needed, leading to the largest reduction in impacts while protecting priority assets. Assets may be environmental, primary production or community (human health, infrastructure or cultural). A prioritised approach to invasive species management ensures maximum benefit from finite resources.

The NSW Weed Risk Management system is a tool developed to assist managers in NSW to determine priorities for weed management. The system uses a series of questions to score weed risk (invasiveness, impacts and potential distribution) and feasibility of coordinated control (control costs, persistence and current distribution). These scores help prioritise weed management, whether that involves eradication, containment or asset protection actions.

The NSW Government controls and regulates the introduction of some non-indigenous animals into NSW and the movement and keeping of those animals within the state. The system used in NSW for assigning non-indigenous animals into risk categories is primarily based on an assessment of three factors:

1. The risk that an escaped or released individual would harm people;
2. The risk that escaped or released individuals would establish a wild free-living population in NSW; and
3. The risk that the species would be a pest if a wild population did establish

DPI manages a licensing and permit scheme for the keeping and movement of some non-indigenous animals that are deemed to be in the higher risk category.

In NSW, the Saving our Species program sets the main priorities for protecting threatened species from the impacts of pest plants and animals. It assigns threatened species to different management streams so the individual requirements of each species can be met. Strategic priorities are also outlined in threat abatement plans (TAPs; see Case Study 3 in this Plan for information on Bitou Bush management and the TAP) and the Biodiversity Priorities for Widespread Weeds.

The Biodiversity Priorities for Widespread Weeds, published in 2011, followed three initial steps:

1. Identifying the widespread environmental weeds within each region;
2. Identifying the native biodiversity (including threatened species) most at risk from these weeds;
3. Ranking sites and targeting weed management to sites where action would lead to the greatest protection of those native biota most threatened by weeds.

The community also has a role in prioritisation. Landholders also have limited resources and face significant impacts from a variety of invasive plants and animals, the extent of which varies between species and from region to region. Landholders who share concerns over the impacts they face from invasive species can achieve significant impact reduction through collaborating with their neighbours and coordinating agreed control efforts (sometimes referred to as the “tenure neutral” approach). Efforts to control wild dogs (Case Study 4 in this Plan) demonstrate the benefits of collaborative efforts.

At all levels (local, regional, state and national) and at all stages of invasion (prevention, eradication, containment and asset protection), monitoring invasive species management activities is required. Monitoring measures the effectiveness of our actions in reducing the impacts of invasive species and provides data on return for investment. Using this information, invasive species programs can be reviewed and evaluated, and investment of resources (human and financial) realigned as/if required.

Challenges, goals and actions

This plan recognises that the best way to deal with invasive species is to prevent them coming into the state. However, when invasive species do come into NSW they can establish quickly, and unfortunately, many species are already widespread. The presence of invasive species here has very real implications for NSW's economy, environment and social wellbeing.

This plan seeks to continue to deliver on the four goals identified in the NSW Invasive Species Plan 2008-2015 to address these challenges.

This plan has four goals:

4. Exclude – prevent the establishment of new invasive species

The challenge is to identify high risk species, assess their potential invasiveness and implement effective barriers to prevent establishment.

5. Eradicate or contain – eliminate or prevent the spread of new invasive species

The challenge is to develop and deploy effective and efficient ways to eradicate or contain an invasive species before it becomes widespread.

6. Effectively manage – reduce the impacts of widespread invasive species

The challenge is to manage or control these species to reduce their impact where the benefits of control are greatest.

7. Capacity building – ensure NSW has the ability and the commitment to manage invasive species

The challenge is for NSW to maintain and further develop the knowledge, skills, resources and systems to address the impacts of invasive species.

From these goals flow a series of objectives, actions and outcomes/outputs that demonstrate how the broader goals relate to on-ground actions. Throughout this plan case studies have been included to illustrate how stakeholders are currently implementing invasive species management.

Goal 1 – Exclude

Exclude – prevent the establishment of new invasive species

Indicator	• **No new invasive species become established**			
	Vertebrate pests	**Weeds**	**Aquatic pests**	**Invertebrate pests**
Lead agency	DPI	DPI	DPI	DPI
Implementation	state government, industry, LLS	local and state government, industry	state and local government, industry	state and local government

1.1 Objective – high risk species and pathways identified and managed

Action
Develop species risk assessment frameworks
Undertake risk assessment processes to identify potential high risk pathways
Review legislative arrangements for control of high risk pathways
Implement legislation, education and enforcement programs for effective management of high risk pathways
Assist high risk pathway industries to develop industry codes to mitigate risk
Industry develops and implements labelling standards for invasive species
Outcomes/outputs
Species risk assessment framework developed
High risk pathways identified
Effective engagement with stakeholders in the legislative review process
Appropriate legislation and effective enforcement mechanisms in place
Industry implementing codes of practice
Industry labelling standards developed and implemented

1.2 Objective – early detection capabilities are developed and implemented

Action
Review existing early detection capabilities
Improve capacity and develop tools to identify and report suspected new invasive species
Respond effectively to invasive species reports
Maintain diagnostic and identification services
Maintain NSW invasive species databases and make accessible to stakeholders
Outcomes/outputs
Increased capacity for early detection
Fewer established incursions
Lists of high risk species developed
Incursion plans for very high risk species
Increased public access to invasive species databases

1.3 Objective – consistency between state and national legislation and protocols

Action
Develop state protocols consistent with national approaches to address high risk pathways
Support national standards of labelling for risk assessment of imported species
Work with other jurisdictions to develop consistent invasive species management approaches

Outcomes/outputs
Invasive species management approaches developed that are consistent with national agreements
Improved transparency in the labelling of imported species

Case study 1 – Efforts to keep tilapia out of the Murray Darling Basin

Tilapia (*Oreochromis spp.*) are an internationally recognised pest fish that originate from the warm waters of southern Africa. Tilapia are hardy fish that tolerate both fresh and salty water and were a popular ornamental species before being banned in NSW and other Australian jurisdictions. They can tolerate a wide range of environmental conditions and are known to aggressively compete with other fish species for food and space.

Tilapia have established wild pest populations that dominate native fish communities in parts of Queensland, including catchments that lie directly adjacent to the Murray Darling Basin (MDB). As with many pest fish incursions, it is thought the first tilapia incursions in Queensland, and their subsequent spread, are likely to have been facilitated by deliberate or accidental actions by community members. So far, tilapia have not been detected in the MDB, however a coastal population of *O. mossambicus* was detected in northern NSW in November 2014 and research has suggested the species could become widespread if it were to be introduced into the MDB.

Photo: Tilapia (*Oreochromis mossambicus*) are mouthbrooders: they keep their young safe from predators by protecting them in their mouth (credit: Queensland Government).

In 2010, a joint project by the NSW and Queensland governments and the MDB Authority recognised the critical importance of stakeholder education in excluding tilapia from the MDB. The project identified areas at high risk of tilapia incursion, and gathered information on community understanding of pest fish issues, as well as attitudes and behaviours that may contribute to the spread of tilapia. This information was then used to develop an education package that was presented and distributed in the high risk areas to improve knowledge of pest fish issues and reduce the risk of tilapia being intentionally translocated into the MDB.

The project also identified the need to increase the ability of government and the community to rapidly detect and respond to new tilapia incursions. Subsequently, the research component of the project aimed to improve traditional physical surveillance techniques, including electrofishing

and netting. It also investigated emerging rapid detection techniques such as the genetic diagnostic tool known as environmental DNA (eDNA), which has been successfully used to detect and monitor fish species in other parts of the world. This technique has the potential to allow much earlier detection of a new tilapia incursion in NSW when physical sampling methods have limited success. Researchers from Queensland are continuing to investigate the potential use of eDNA to detect tilapia in Australian environments, and the incursion in northern NSW was used as a test-case for this tool in NSW waters.

It is hoped that the combination of education of waterway users, improved science and a coordinated management approach will prevent the further spread of tilapia into new river systems, particularly the MDB, and that populations can be contained and managed at environmentally acceptable levels into the future. These ongoing actions will assist in the protection of our natural environment and help sustain native freshwater fish populations for future generations.

Goal 2 – Eradicate or contain

Eliminate or prevent the spread of new invasive species

Indicators	• **Reduced distribution and/or abundance of priority emerging species** • **Success of eradication programs**			
	Vertebrate pests	**Weeds**	**Aquatic pests**	**Invertebrate pests**
Lead agency	DPI	DPI	DPI	DPI
Implementation	state government, LLS, industry, private and public land managers	state and local government, LLS, industry, private and public land managers	state and local government, LLS, industry, private and public land and water managers	state and local government, LLS, industry, private and public land managers

2.1 Objective – timely detection of new incursions

Action
Maintain and promote community hotlines
Maintain surveillance capabilities for high risk species
Increase the capacity of stakeholders to recognise, detect and report new incursions
Enhance existing community surveillance networks
Improve communication and reporting networks between agencies and stakeholders
Outcomes/outputs
Functioning hotlines for the timely reporting of new incursions
New incursions of priority species detected and eradicated where practical
Educational material available on identification of high priority species
Arrangements in place to enable appropriate investigations of hotline reports of high priority species

2.2 Objective – rapid response to eradicate or contain new invasive species

Action
Develop rapid response plans and cost-sharing agreements
Develop and implement appropriate surveillance, eradication or containment programs for new incursions
Maintain research capacity to deal with new, emerging and emergency management issues
Maintain the effectiveness of eradication or containment programs
Outcomes/outputs
Prompt containment or eradication and appropriate monitoring of new incursions
Cost-sharing arrangements in place involving key stakeholders
Novel detection and management techniques developed
Periodic review of high risk invasive species programs

Case study 2 – Attempts to eradicate tropical soda apple from NSW

Tropical soda apple *(Solanum viarum*; TSA*)*, a native of South America, is an aggressive prickly perennial shrub growing up to 2 m high. It invades open to semi-shaded areas, including pastures, forests, riparian zones, roadsides, recreation areas, horticultural and cropping areas. A sample of a previously unknown weed was collected on the NSW mid-north coast and it was identified as the first incursion of TSA in Australia in August 2010. The subsequent discovery of TSA at several cattle handling facilities indicated that cattle were a significant vector for the weed.

Photo: Mature tropical soda apple plant (credit: Josh Biddle)

The National Livestock Identification System (NLIS) data was used to trace cattle movements from affected properties throughout NSW and into other Australian states. This was advantageous as there were few other mechanisms to systematically trace weed incursions. A pathway analysis was conducted to determine where this weed was likely to occur across NSW, also through the use of NLIS. Importantly, information was used to pinpoint surveillance activities for local Weeds Officers, thus ensuring efficient use of resources. The data also allowed the probability of incursions at these sites to be modelled. Surveillance is continuing at high risk sites.

An important part of the coordinated response to this incursion was the establishment of a Rapid Response Team, which consisted of Weeds Officers from the member Councils of the Northern Inlands Weeds Advisory Committee and officers of the Northern Tablelands LLS. This team has proven to be effective and efficient in combatting the threat of TSA in the Macleay Valley. The ability to bring together not only the expertise of Weeds Officers but also the pooling of resources, such as vehicles and equipment, allowed the planned control programs to be implemented in a timely manner and educated landholders on the importance of eradicating this most aggressive pest plant.

Photo: The tropical soda apple Rapid Response Team on the banks of the Macleay R (credit: Josh Biddle)

The management program for TSA has been very productive to date, with participating councils having considerable success in conducting on-ground control, compliance and education programs. In 2013 control obligations for the TSA were increased to recognise the species as an eradication target. Significant financial contributions from several LLS has enabled Local Government Weeds Officers to tackle difficult to reach sites within the affected region. Although there is a long way to go, this program demonstrates that a diligent and strategic approach can reverse the progress of even an aggressive weed such as TSA.

Due to the responsiveness and ingenuity of program collaborators, TSA has been confined to a small number of locations, and as at March 2015 eradication still looks feasible.

Case study 3 – Protecting NSW from the biosecurity threats of non-indigenous animals: African pygmy hedgehog

In 2014, acting on information provided by a concerned member of the public, the Biosecurity NSW Branch of DPI executed a search warrant and as a consequence seized an African pygmy hedgehog, *Atelerix albiventris* from a private residence. During the property inspection the African pygmy hedgehog was discovered kept in a cage, in the wardrobe of a bedroom in the house. The DPI regulatory officer investigating the matter also identified a number of illegally kept non-indigenous snakes, lizards and turtles kept at the residence. In the conviction of the offender the court raised the seriousness of the offence, the dangers to the environment and the economy of unlawfully keeping such animals.

The African pygmy hedgehog is bred and sold as a pet in places like North America and the United Kingdom. However, the species is prohibited throughout Australia for a number of reasons including its potential to introduce exotic animal diseases and because the species has the ability to become a serious invasive pest in Australia. Hedgehog species have a proven history as an invasive pest and have established feral populations in New Zealand and Scotland. Once established in a new environment, hedgehogs are able to cause damage to native species including insects, snails, lizards and ground-nesting birds, particularly shore birds. Hedgehogs also have the potential to seriously damage the Australian economy due to their ability to harbour exotic animal diseases such as foot and mouth disease. Other endemic diseases carried by hedgehogs including Salmonella, Q fever and Toxoplasmosis which are all capable of being transmitted to humans.

Photo: An African pygmy hedgehog seized by NSW DPI (credit: NSW DPI)

In 2014 Biosecurity NSW embarked on work with an international research group to analyse the DNA of the seized animal to determine its genetic relatedness to other African pygmy hedgehog populations. This work will also help regulatory agencies to understand what markers are unique to different populations within the world and will also help to understand disease threats based on the endemic diseases of those regions.

Case study 4 – Bitou bush management: protection of environmental assets

Bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*) is a South African invasive shrub that was inadvertently introduced to Australia, then deliberately planted on the NSW coast from 1946 to 1968, to stabilise coastal sand drifts and revegetate dunes following mining.

Concerns about the impact of Bitou bush on native species and ecological communities resulted in its listing as a Weed of National Significance (WoNS), a noxious weed, and as a Key Threatening Process under the NSW *Threatened Species Conservation Act 1995*. As it is widespread and unlikely to be eradicated, control efforts are targeted at containing spread and protecting important environmental assets.

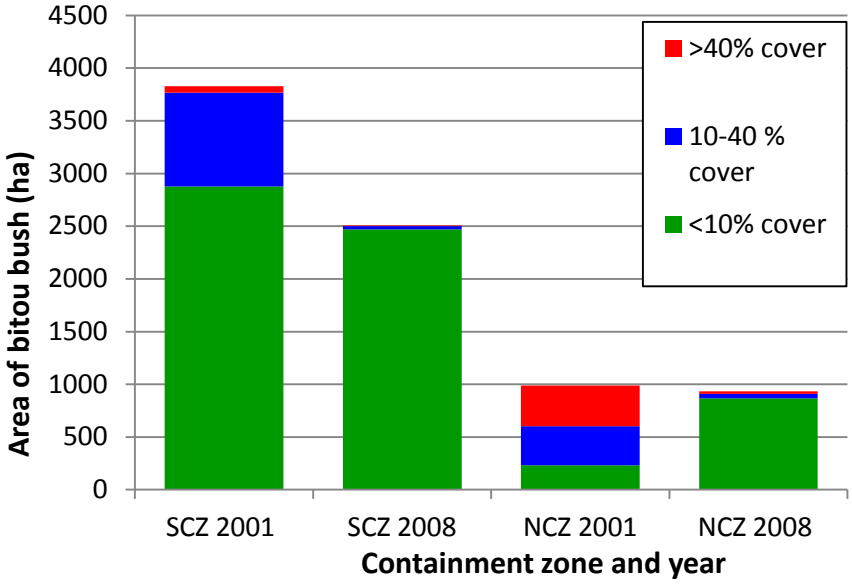
Photo: Bitou bush invading oceanfront dunes (Credit: Hillary Cherry)

In 2006, the NSW Bitou Bush Threat Abatement Plan (TAP) outlined an approach for the protection of environmental assets at risk from Bitou bush. The TAP prioritised sites for control by considering biodiversity impact and likelihood of effective control. The core objectives of the plan are to: (i) undertake control where benefits to biodiversity are greatest, including control alleviating impacts to priority biodiversity, and contain the northern and southern spread (as per the Bitou bush WoNS strategy); and (ii) evaluate the effectiveness of control programs in protecting biodiversity.

Stakeholders including the National Parks and Wildlife Service (NPWS), Local Government, LLS, community groups and Crown Lands worked together to implement the TAP across various tenures. In 2011, after five years of implementation, the TAP was reviewed. Some key outcomes include:

- Strategic management of Bitou bush was achieved at almost three quarters of the 157 managed sites that were the highest priority for conservation;
- Bitou bush density and extent were reduced in national containment zones, as determined through mapping of Bitou bush in NSW; and
- Monitoring programs were established at 76 sites, and where data was sufficient and long-term control programs were in place, results indicated an increase in the abundance of native plant species.

Figure: Change in area and density of bitou bush in the southern (SCZ) and northern national containment zone (NCZ).



A key component of implementation was preparation of site-specific management plans that: ensure weed control focuses on protecting priority biodiversity; plan for follow-up control, and outline how off-target damage to native species will be minimised.

It is recognised that persistence and long-term commitment to Bitou bush management is critical. The TAP Review concluded that with strong coordination, sufficient funding and support to land managers, management of widespread weeds to alleviate biodiversity impacts and contain further spread is achievable.

The Bitou bush program will contribute to regional growth and the performance of the NSW economy whilst minimising damage to our natural environment. This program is an outstanding demonstration of community involvement in controlling an invasive plant.

Goal 3 – Effectively manage

Reduce the impacts of widespread invasive species

Indicator	• **Success of control programs for selected widespread invasive species**			
	Vertebrate pests	**Weeds**	**Aquatic pests**	**Invertebrate pests**
Lead agency	DPI	DPI	DPI	DPI
Implementation	state government, LLS, industry, private and public land managers	local and state government, LLS, industry, private and public land managers	state and local government, LLS, industry, private and public land and water managers	state government, LLS, industry, local government, public land managers

3.1 Objective – identification and prioritisation of management programs where return on investment greatest

Action
Provide clear benchmarks and processes to measure invasive species impacts and prioritise management actions
Identify where invasive species are having the greatest impacts on primary industries, environment, human health or infrastructure
Prioritise management efforts based on impacts
Outcomes/outputs
Management programs prioritised to give the greatest benefit and targeted to those assets most at risk

3.2 Objective – effective and targeted on-ground control

Action
Develop and implement state and regional management plans for high priority species
Integrate state and regional management plans
Develop best practice guidelines where required
Support cooperative programs that use integrated management across all tenures
Identify opportunities to include appropriate land use change, commercial harvesting, hunting and fishing as part of management
Monitor the effectiveness of management programs and adapt as required
Ensure regulatory framework appropriate for the development and implementation of new control techniques
Outcomes/outputs
Impacts reduced at priority sites
Regional and local cooperation and coordination enhanced
Regional and state management plans integrated
Programs are effective across all tenures
Impact assessments used to identify management options
Streamlined implementation of new control techniques

Case study 5 – Coordinated control of wild dogs

The Brindabella/Wee Jasper wild dog control group was formed in 2000 to address predation on livestock in the area. The group identified the majority of losses were caused by wild dogs and foxes. It was the first NSW group to develop a tenure neutral approach to wild dog and fox control, and was initially made up of landholders, Yass Rural Lands Protection Board (now South East LLS), State Forests and NPWS. This approach was successfully trialled in 2001 and 2002, and due to this success and the positive support from land managers, there was a strong recommendation that the program be extended.

Initial objectives were:

- Maintain a representative group of private and public land managers to coordinate wild dog /fox management activities;
- Formulate and implement a 3 year wild dog/fox management plan that is accurately costed and resourced;
- Ensure the conservation of dingo populations in core areas;
- Monitor the program to ensure an effective evaluation of the control activities;
- Regularly promote the progress of the program;
- Ensure land manager support is provided and maintained.

Photo: Wild dog management plans need to give consideration to dingos (pictured) and the conservation of their populations (credit: Paul Meek)

The initial plan utilised proactive and reactive trapping, as well as bait stations. Prior to the plan's implementation, records show that on average there were over 150 sheep killed annually in the area and 40 others mauled. This number has reduced over the life of the plan, but can still fluctuate in some years.

The benefits of the initial cooperative program included:

- more efficient and effective utilisation of resources;
- increased proactive rather than reactive control efforts;
- control efforts were programmed, mapped and costed for the area;
- coordinated resource commitments achieved significant efficiencies and cost savings;
- landholders acknowledged the importance of reporting;
- landholders saw results from the reporting process, with accurate information shared across land managers;
- best practice use of control measures;
- improved relations amongst the community.

Over the years this plan has evolved to include more land managers in the area, and has extended into the adjoining ACT to further enhance the program. The tenure neutral approach has also been adopted across the state for control of wild dogs and other pest animals. The plan has a full time controller who regularly surveys the area and conducts proactive and reactive control to reduce stock loses and wild dog populations. This is enhanced by regular coordinated baiting programs carried out by land managers in the area.

Benefits of the tenure neutral approach include:

- Overcoming the traditional approach to pest species management eg: "it's not my problem - all the pests are coming from your lands";
- Encourages all land managers in the area to collectively take ownership of a landscape issue and formulate a shared, landscape-scale solution;
- Clearly defines any short falls or gaps in resources or areas requiring pest management;
- Commits all land managers to an agreed course of action over the term of the plan.

The Brindabella/Wee Jasper wild dog control group has demonstrated that for pest animal control to work everyone has to accept some of the problem and also be part of the solution. Implementation of this plan continues with land managers of private and public lands represented on the wild dog working group which is jointly coordinated by South East LLS and Riverina LLS.

Capacity to manage invasive species

NSW faces an ongoing challenge to have the knowledge, skills, resources and systems to address the impact of invasive species. We must maintain, or improve where necessary, the state's capacity to respond to, manage and control biosecurity threats. This plan contributes to providing an effective foundation for all stakeholders to work together and make the best use of the available knowledge and expertise across all groups. Effective stakeholder engagement, including targeted education and information programs, will increase the capacity and capability in invasive species activities of all stakeholders.

Everyone has a role

Everyone has a role to play in invasive species management. The dumping of unwanted pets contributes to pest animal populations including feral cats, wild dogs and invasive fish in our waterways. Likewise, inappropriate disposal of garden waste can contribute to new weed infestations. We can all make an important contribution to invasive species management by buying pets and plants from reputable suppliers and caring for our pets and plants to prevent escapees.

Participation in community programs, such as Landcare, contributes to the ongoing efforts to manage widespread pests and helps build resilience in the natural environment to help reduce the risks from pests and weeds.

Partnerships are important

DPI works closely with other key stakeholders in invasive species management. For example, DPI works with Local Government to lift and maintain the capacity to manage weeds in NSW. This program is supported through the provision of NSW government grants for state and regional projects, currently delivered through the NSW Weeds Action Program. Under this program regional projects are guided by Regional Weeds Advisory Groups, with strong and established partnerships and communication pathways with key stakeholders who manage weeds in NSW. DPI also coordinates training for invasive species management, delivers information resources and manages website content to share resources and enhance the engagement of weed and vertebrate pest professionals.

Understanding drivers for community participation

Most programs to encourage community participation in managing invasive species rely on the dissemination of information. Research demonstrates, however, that simply providing information has little or no effect on what people or businesses do. Community based social marketing (CBSM) is a structured framework which incorporates scientific knowledge on the psychology of human behaviour into the design and delivery of community programs to achieve long term behavioural change. Initiatives that apply CBSM methodology to state and regional pest management programs in NSW commenced in 2013 and are ongoing.

Formal agreements

National agreements

Strong partnerships that are reinforced by formal agreements are vital for effective invasive species management. NSW participates in the national framework for biosecurity arrangements, which includes contributing to the development of and being signatory to agreed emergency response, including cost sharing, arrangements that reflect the shared responsibility for biosecurity. Many national industry bodies are also signatories to these agreements, and work is continuing to encourage broader participation.

Memoranda of Understanding

Memoranda of Understanding (MoUs) are very common and are used widely, from domestic purposes to agreements between nations. MoUs specify mutually-accepted expectations between two or more people or organizations working towards a shared goal. They are formal documents which detail agreed undertakings, outcomes and actions between signatories. MoUs are usually developed in a spirit of partnership; they are less formal than contracts, are not generally legally binding and generally don't involve the exchange of money between the signatories.

Emergency preparedness and response

Being prepared and responding quickly are vital to limiting the impacts of invasive species incursions. DPI leads biosecurity emergency responses in NSW and will continue to partner with key stakeholders, industry and the community to encourage greater participation in biosecurity emergency activities that reduce the environmental, economic and social impact of significant emergency pest and weed outbreaks. The capacity of skilled agency and industry personnel will be increased through preparedness, training and exercising for response roles.

The actions, outcomes and outputs to ensure NSW has the capacity to effectively manage invasive species are further detailed in Goal 4.

Goal 4 – Capacity building

Ensure NSW has the ability and commitment to manage invasive species

Indicators	• **Number of people with relevant training in the management of invasive species** • **Number of community groups involved in the management of invasive species** • **Reporting avenues established, resourced and promoted**			
	Vertebrate pests	**Weeds**	**Aquatic pests**	**Invertebrate pests**
Lead agency	DPI	DPI	DPI	DPI
Implementation	LLS, state government, industry, private and public land managers	local and state government, LLS, industry, private and public land managers	state and local government, LLS, industry, private and public land and water managers	state government, LLS, industry, local government, private and public land managers

4.1 Objective – government manages high priority invasive species on public land and waterways

Action
Ensure control obligations are effectively applied by all land and water managers
Adequately resource priority invasive species management
Develop management plans for high priority Crown and other public lands
Outcomes/outputs
Develop and/or participate in partnerships with adjoining and affected private landholders and community (tenure neutral concept)
Invasive species on public lands and waterways are managed effectively

4.2 Objective – private landholders and community motivated to exclude, help identify and respond to new, and manage existing invasive species proactively

Action
Develop and implement communication campaigns that increase target audience awareness and understanding
Publicise “success stories” and also the penalties imposed for non-compliance
Develop and implement incentives where appropriate for the management of invasive species on non-productive land and to protect biodiversity
Outcomes/outputs
Increased knowledge amongst private landholders and community of ways to prevent incursions of new invasive species
Improved awareness and use amongst private landholders and community of invasive species reporting mechanisms
Greater vigilance by landholders and community and increased identification and reporting of unfamiliar invasive species
Increased understanding and compliance during emergency response and recovery
Increased industry participation in emergency preparedness and response arrangements
Invasive species on private lands are managed effectively
Increased number of stakeholders participating in coordinated programs

4.3 Objective – increased community involvement in effective invasive species management

Action
Develop and implement targeted communication campaigns based on surveys of community perceptions
Identify further opportunities for community involvement
Review and improve information delivery to support stakeholders with access to current research, databases, information and training
Inform stakeholders of their legal and community responsibilities
Build on existing communication networks to ensure effective dissemination of resources and information to all stakeholder groups
Provide facilities and technology to minimise the introduction and spread of invasive species
Maintain and build on existing volunteer networks
Outcomes/outputs
Increased understanding of social factors influencing implementation of biosecurity practices
Increased community, private landholders and stakeholders participation in invasive species eradication, containment and impact reduction efforts
Community and stakeholders accept the need for and involved in management programs
Use of facilities and technology to minimise the introduction and spread of invasive species
Opportunities created to share best practice
Early detection of new incursions enhanced
Community, industry and government share the responsibility to manage invasive species

4.4 Objective – integration of invasive species management into education programs

Action
Review current education and training programs to identify gaps and integrate invasive species issues
Promote and encourage invasive species awareness through participation in existing programs
Regularly update education providers on invasive species initiatives
Regularly review and adapt education programs
Develop a range of information, education and training resources
Outcomes/outputs
Increased awareness of and involvement in invasive species management
Increased participation in invasive species education and training
Improved uptake of invasive species resources and best practice messages
Trainers/teachers can access tools to help increase understanding of invasive species

4.5 Objective – skilled workforce implementing invasive species management

Action
Develop competency based education and training courses for specific stakeholders groups including volunteers
Regularly review and adapt education and training programs
Outcomes/outputs
An increase in the number of operators holding competency based qualifications
Training programs remain contemporary

4.6 Objective – ability to measure the effectiveness of invasive species management

Action
Provide guidelines for monitoring, evaluation and reporting
Consolidate, evaluate and report state, regional and local monitoring information
Outcomes/outputs
State-wide databases developed and maintained
Monitoring programs implemented

4.7 Objective – improve knowledge base for invasive species management

Action
Review existing knowledge to identify gaps and prioritise future research
Maintain research capacity and capability
Build research skills through recognition and training
Strengthen research to develop and improve management methods
Undertake research on the ecology of invasive species and the effects of both climate change and general environmental changes on invasiveness
Outcomes/outputs
Research priorities identified
Research capacity and capability maintained or improved
Research conducted and results published and extended
Best practice methods available, including for detection and control
Better understanding of invasive species and the effects of change on invasiveness

4.8 Objective – roles and responsibilities defined for invasive species management

Action
Ensure roles and responsibilities for each stakeholder are clearly defined and understood
Establish regional advisory networks for the management of invasive species
LLSs and state agencies implement and report on Natural Resources Commission targets and indicators for invasive species
Outcomes/outputs
Arrangement in place for managing invasive species
Memoranda of Understanding implemented where appropriate
Reporting requirements met

4.9 Objective – commitment to implement components of Invasive Species Plan 2015-2022

Action
Include actions from this plan in relevant planning documents
Continue programs and incentives for invasive species
Direct weed grant funding to assist implementation of state and regional strategies
NSW Government continues to participate in national invasive plant and animal consultative arrangements
Outcomes/outputs
Plan meets its objectives

4.10 Objective – legislation and policies implemented and enforced consistently for effective invasive species management

Action
Review current legislation to address overlaps, gaps and inconsistency with NSW and other national legislation
Ensure all legislation is integrated with agency policies and strategies
Ensure legislation enables the containment and eradication of high risk invasive species
Ensure control obligations consistently applied across all land managers and are tailored to the invasive species characteristics
Develop materials to educate and guide all stakeholders in compliance obligations
Develop improved enforcement capabilities
Outcomes/outputs
Legislation and policies in place for effective management of invasive species with appropriate options for enforcement
Consistent approaches are adopted and implemented
Future impacts of invasive species are reduced
Invasive species are managed in an holistic manner
All stakeholders are aware of their responsibilities and obligations
Appropriate regulatory options enforced

4.11 Objective – monitor progress of implementation of this Plan

Action
Task DPI, in consultation with the NSW Pest Animal Council and NSW Noxious Weeds Advisory Committee to monitor implementation of this Plan
Develop reporting arrangements to communicate the performance of the Plan to stakeholders
Outcomes/outputs
Plan meets its objectives

4.12 Objective – have established emergency response (including cost sharing) arrangements

Action
Develop cost-sharing models
Lead Agencies defined for invasive species activities
Participate in the Intergovernmental Agreement on Biosecurity (IGAB) and the national emergency response arrangements: the National Environment Biosecurity Response Agreement (NEBRA), the Emergency Animal Disease Response Agreement (EADRA) and the Emergency Plant Pest Response Deed (EPPRD)
Outcomes/outputs
Emergency response, including cost sharing arrangements, in place
Ongoing communication and collaboration between agencies with an interest in invasive species
Engage with all stakeholders to ensure appropriate alignment with reporting and response activities

Case study 6 – Novel emerging techniques in invasive species management: integrated aerial surveillance, thermal imaging and mapping pilot project

The Northern Inland Weeds Advisory Committee (NIWAC) has coordinated weed management in the New England and North West regions. It comprised key stakeholders from Tenterfield in the north, south through the New England to Tamworth and the Liverpool plains, and extending west to Gunnedah, Narrabri and Moree, the area comprising 100,000km² including 10 Local Control Authorities.

Since 2010, new weed incursions of tropical soda apple and alligator weed have occurred in various locations within the NIWAC region, often occurring in inaccessible and remote areas, requiring considerable costs and resources to carry out initial surveillance, mapping, recording and control.

As part of the Weeds Action Plan 2010 – 2015, NIWAC coordinated a regional inspection program for new high risk invasive species. This project took the regional inspection program to the next level by way of a feasibility study and cost benefit analysis of integrating new technology including unmanned aerial vehicles (UAVs), thermal imaging and a proven existing mapping system (Weedtr@cer) for the detection and surveillance of high risk invasive weed species.

Photo: The "hexicopter" unmanned aerial vehicle being trialled to detect high risk weed incursions (Credit: University of Sydney)

The project engaged partners who have proven knowledge in UAV innovative technology with the purpose of building further capacity of Weed Officers in best practice techniques of aerial surveillance, thermal imagery and integrated mapping processes.

In summary, the objectives of the project include:

- To have an in-depth understanding of current UAV applications to on-ground surveillance of pest weed species;

- To investigate and determine the optimal settings for future data collection for four weed species at different altitudes;
- To perform a cost benefit analysis comparing the use of unmanned aerial vehicle surveillance, maintenance and operational costs against the conventional methods of utilising on-ground surveillance and aerial inspections by manned helicopter; and
- To explore the operational requirements and the technical and legal implications of the use of deploying unmanned aerial vehicles in surveillance and monitoring of pest weed species.

The University of Sydney Centre for Field Robotics was engaged to study weed detection using low altitude aerial images of tropical soda apple, serrated tussock, alligator weed and water hyacinth. The study demonstrated that it is possible to correctly classify weeds of interest from remote sensing data collected from a small UAV. For example, alligator weed detection was achieved for patch sizes of 0.06 m^2, while another study by the Centre for Field Robotics has demonstrated detection of orange hawkweed flowers that only grow to 15 mm in diameter.

An independent cost-benefit analysis is being undertaken into the effectiveness and financial viability of the use of unmanned aerial vehicles for detection and surveillance of pest weed species.

It is envisaged that this pilot project will have significant positive outcomes for the whole state that could change the way in which future inspections, surveillance and mapping of weeds is carried out.

Case Study 7 – Red Guide Posts: preventing the further spread of high risk weeds by road users

Weeds incursions are most effectively controlled by a cooperative approach between agencies, land holders and the community. Weeds are spread in a number of ways, including mechanical spread (ie human or vehicle assisted). The state pilot Red Guide Post project adopted a coordinated approach to tackling this pathway (means by which weeds move) by alerting road users of high risk sites to avoid while management takes place.

In 2014 the Eastern & Western Riverina Noxious Weeds Advisory Groups (ERNWAG & WRNWAG) teamed up with the Lachlan Valley & Macquarie Valley Weeds Advisory Committees (LVWAC & MVWAC), 33 partnering Local Control Authorities (LCAs) and Murray LLS to develop and promote the Red Guide Post initiative.

Red Guide Posts are being installed along roadsides throughout NSW by LCA weed officers to identify known locations of high risk weeds. The posts alert road users of the area they are asked to avoid to prevent further spread of these weeds along roadsides and other high risk pathways.

As at April 2015, Red Guide Posts have been installed to identify parthenium weed, Chilean needle grass, serrated tussock and coolatai grass sites. As a new weed infestation is detected, red guide posts are installed at the beginning and end of the incursion zone to alert the public and assist in preventing the weeds' spread while the site is being managed. By avoiding the site, road users help prevent the spread of invasive species and assist weed officers to effectively manage priority weed incursions. The resources help agencies to engage with road users and encourage them to be proactive and avoid high risk sites.

Photo: The Red Guide Post program included the production and distribution of educational stickers for car windows (Credit: Eastern & Western Riverina Noxious Weeds Advisory Groups)

A major component of the pilot project was the development of resources which Roads & Maritime Services, LLS and other LCAs are encouraged to use across the state. Resources produced through this project include TV commercials, radio advertisements, fuel nozzle advertising, fact sheets and other educational materials (see www.riverinaweeds.org.au for details and to download resources). The use of these resources will ensure state-wide consistency.

Key project outcomes have included a reduction in unauthorised works taking place in red guide posted areas, as well as increased community acceptance of and involvement in effective invasive species management. The Red Guide Post program is an award-winning and innovative approach to community engagement for high risk weed management.

NSW legislation and invasive species management

The Department of Primary Industries (DPI) is the lead agency in NSW for invasive species management. As at February 2015, DPI manages a variety of Acts dealing with various aspects of invasive species management, with different Acts dealing with animal and plant pests, which are different again for pest fish. In recent years DPI has undertaken a comprehensive review of biosecurity-related legislation to identify and remove duplication and inconsistencies, particularly regarding emergency management, compliance and enforcement. The NSW government is developing a new NSW Biosecurity Act which will address these issues, further empower industry and stakeholders to self-manage invasive species and clarify their rights, responsibilities and obligations. It is expected that this new Biosecurity Act will be implemented in NSW during 2015-16. This addresses a key goal (Goal 4) of the NSW Biosecurity Strategy 2013-2021.

Other key pieces of NSW legislation relevant to invasive species management which will continue to operate in tandem with the *NSW Biosecurity Act* (when enacted) include:

- *Local Government Act* 1993
- *Local Land Services Act* 2013
- *National Parks and Wildlife Act* 1974
- *Threatened Species Conservation Act* 1995
- *Forestry and National Park Estate Act* 1998
- *Crown Lands Act* 1989
- *Crown Lands (Continued Tenures) Act* 1989
- *Native Vegetation Act* 2003
- *Prevention of Cruelty to Animals Act* 1979
- *Game and Feral Animal Control Act* 2002

Note: The NSW Government is developing a new legislative framework to replace the *Threatened Species Conservation Act 1995*, *Native Vegetation Act 2003*, *Nature Conservation Trust Act 2001* and parts of the *National Parks and Wildlife Act 1974*.
In designing the biodiversity reforms, the government will ensure the new arrangements operate effectively with the *NSW Biosecurity Act*. Information about the biodiversity reforms is available at http://www.environment.nsw.gov.au/biodiversitylegislation/review.htm

Implementation of the NSW Invasive Species Plan

The NSW Invasive Species Plan is a strategic document that will help prioritise and direct invasive species management programs, funding and resources for NSW. The Plan acts as a starting point to develop new action strategies while embracing existing strategies that are complementary to the Plan's objectives.

Agencies, stakeholders and community groups all have a role to play in implementation of this Plan. For example, this Plan is seen as a vital document for planning and works programs regarding weed management in NSW, and Local Control Authorities will ensure it is incorporated into Weed Action Program initiatives for 2015-2020 and beyond. NSW DPI will continually look for other opportunities to promote the wider adoption of this Plan with stakeholder groups.

NSW DPI has a well-established formal stakeholder consultative framework at which invasive species management issues are discussed, including the Pest Animal Council and the State Weeds Committee (formerly the Noxious Weeds Advisory Committee). Committees such as these allow key stakeholders, including peak industry bodies, Local Control Authorities, public and private land managers and non-government organisations, to have a say in policy direction and priority setting. Many of the representatives on these committees also have an active interest in broader invasive species management. NSW DPI will coordinate reporting against implementation of this Plan in consultation with the NSW Pest Animal Council, the State Weeds Committee and similar groups that are involved in invasive species management in NSW.

Appendix 1 – Glossary of terms

Aquatic	In or on water (fresh, brackish or salt)
Best practice management	Methods or techniques that integrate all available knowledge and research that is proven to deliver the most effective, cost-efficient and humane invasive species control, while making optimum use of existing science and knowledge resources
Biodiversity	The variety of life forms, the different plants, animals, microorganisms and the ecosystems they form
Biosecurity	Protecting the economy, environment and community from the negative impacts of pests, weeds and diseases
Competency based	Training that meets units of competency, which are agreed statements of the skills and knowledge required for effective performance in a particular role or function
Containment	Restricting the spread of an invasive species incursion
Emerging species	A newly established invasive species whose distribution and abundance is expanding
Eradication	The permanent removal of an invasive species, including all individuals and propagules, from a defined area that has little or no likelihood of re-invasion
Establishment	The point at which a species can reproduce at a sufficient level ensuring survival in a new habitat without further input from outside the system
Evaluation	The process or results of an assessment or appraisal in relation to stated objectives, standards or criteria
Impacts	The (usually negative) economic, environmental and/or social effects of invasive species
High priority weeds	Weeds present in a location/region/state and deemed high priority for control
High risk weeds	Weeds with high potential to adapt to specific location/region/state, but not yet present in that location/region/state
Incursion	An isolated population of an invasive species detected in an area where it had not been previously known
Invasive species	A species whose establishment and spread threatens ecosystems, habitats or species with economic or environmental harm
Native species	A species within its natural range (past and present)
New invasive species	Any introduced species that has not been recorded in the area previously and whose impacts are likely to be significant,

Pathways	The passage by which invasive species move eg air, surface water, groundwater, plants, animals and by human agents
Pest	Any plant or animal having, or with potential to have an adverse economic, environmental or social impact
Protocol	A procedure or set of rules
Public land and water	Lands and water managed by public authorities
Public authorities	• a Minister of the Crown; or • local authority constituted by or under an Act; or • a government department or administrative office • a statutory body representing the Crown; or • the trustee of trustees of land reserved or dedicated for any public use or purpose; or • a member of staff or other person who exercises functions on behalf of the above
Risk management	The identification, analysis, control, minimisation or elimination of unacceptable risks
Stakeholders	Those people and organisations with an interest or concern in something
Tenure neutral	An approach which encourages land holders, local communities and government land managers to cooperatively address invasive species issues for a particular area across all land tenures (irrespective of property boundaries) by collectively identifying the scope of the issue and reaching agreement on the management technique and level of resources required to address it
Threatened (species, populations and ecological communities)	A native species/population/ecological community whose survival is at risk: categorised as specified in either the *NSW Threatened Species Conservation Act 1995* or the *NSW Fisheries Management Act* 1994
Vectors	Means allowing the spread of an invasive species into an area or ecosystem
Weeds	Plants that are unwanted in a given situation and which usually have detectable negative economic, environmental or social impacts

Appendix 2 – Abbreviations

CMA	Catchment Management Authority
DPI	Department of Primary Industries
EADRA	Emergency Animal Disease Response Agreement
EPPRD	Emergency Plant Pest Response Deed
IGAB	Intergovernmental Agreement on Biosecurity
LCA	Local Control Authority
LLS	Local Land Services
MDB	Murray Darling Basin
MOU	Memorandum of Understanding
NEBRA	National Environmental Biosecurity Response Agreement
NIWAC	Northern Inland Weeds Advisory Committee
NLIS	National Livestock Identification System
NPWS	National Parks and Wildlife Service
OEH	Office of Environment and Heritage
TAP	Threat Abatement Plan
TSA	tropical soda apple
UAV	unmanned aerial vehicle
WoNS	Weed of National Significance